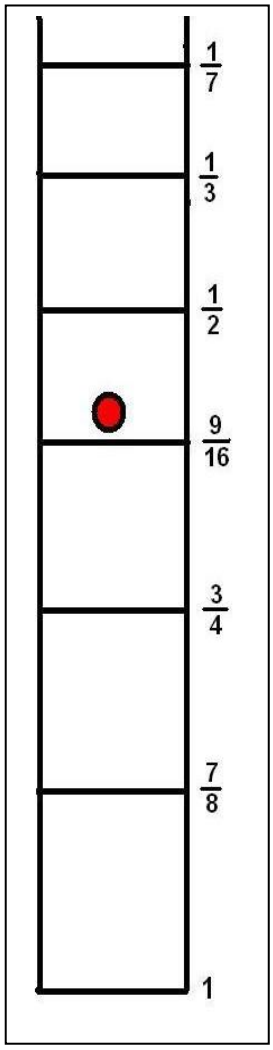


The single electron inside an atom can exist in many different energy states. The lowest energy an electron can have is called the Ground State: this is the bottom rung on the ladder marked with an energy of '1' in the figure to the left.

The electron must obey the Ladder Rule. This rule says that the electron can gain or lose only the exact amount of energy defined by the various ladder intervals.

For example, if the electron jumps from the fourth rung of the energy ladder marked with an energy of '9/16', to the Ground State, the energy change is E = 9/16 - 1 = -7/16 units of energy. This difference is negative, which means that the electron has LOST 7/16 energy units.

In the problems below, leave all answers in the simplest fractions.

Problem 1 - The electron gets a boost of energy and jumps from level 3 to Level 6. How much did it gain?

Problem 2 - An electron falls from Level 6 to Level 2. How much did it lose?

Problem 3 - An electron changes from Level 7 to Level 3. How much did it gain or lose?

Problem 4 - An electron is excited from Level 2 to Level 7. How much energy was gained?

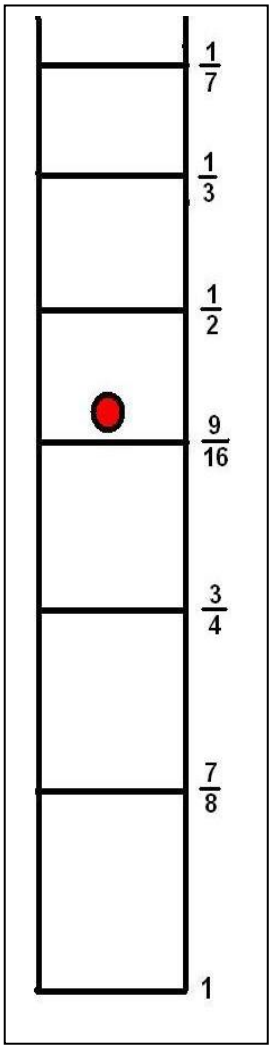
Problem 5 - The atom collides with another atom and the electron jumps from Level 3 to Level 6. How much energy did the other atom lose in the collision?

Problem 6 - An electron jumps from Level 3 to Level 2 and give of a particle of light. What energy is carried off by the light?

Problem 7 - An electron jumps from Level 7 to Level 4, then from Level 4 to Level 2. How much energy was lost with each jump, and what was the total energy lost after the two jumps?

Problem 8 - An electron jumps from the Ground State to Level 5, then is deexcited to Level 3, and after a while it is excited to Level 6, and then loses energy in a jump to Level 2. What is the total energy change of the electron between the start and end of this process?

Answer Key



Problem 1 - Answer: 3/4 - 1/3 = (9 - 4)/12 = +5/12 energy unit. This is positive, so the electron GAINED 5/12 energy units

Problem 2 - Answer: 1/3 - 7/8 = (8 - 21)/24 = -13/24 energy unit. This is negative, so the electron LOST 13/24 energy units.

Problem 3 - Answer: 1/7 - 3/4 = (4 - 21)/28 = -17/28 energy unit. So because this is negative the electron LOST 17/28 energy unit.

Problem 4 - Answer: 7/8 - 1/7 = (49 - 8)/56 = 41/56 energy unit. This is positive so the electron had GAINED 41/56 energy units.

Problem 5 - Answer: 3/4 - 1/3 = (9 - 4)/12 = 5/12 energy unit. This is positive, so the electron has GAINED 5/12 energy units.

Problem 6 - Answer: 3/4 - 7/8 = (24 - 28)/32 = -4/32 = -1/8 energy unit. This is negative ,so the electron LOST 1/8 energy unit, and so there was 1/8 energy unit carried away by the light particle.

Problem 7 - Answer: The sequence is broken into two parts, which can be represented by bracketed quantities:

(1/7 - 9/16) + (9/16 - 7/8)
= 1/7 - 9/16 + 9/16 - 7/8
= 1/7 - 7/8
= (8 - 49)/56
= -41/56

so the electron lost 41/56 of an energy unit. Students may note that this problem is of the form: (A - B) + (B - C) = A - C

Problem 8 - Answer: (1 - 1/2) + (1/2 - 3/4) + (3/4 - 1/3) + (1/3 - 7/8) =
1 - 1/2 + 1/2 -3/4 + 3/4 - 1/3 + 1/3 - 7/8 =
1 + 0 + 0 + 0 - 7/8 =
1 - 7/8 = 1/8.
This net energy is positive, so there was a net gain of 1/89 energy unit by the electron. Note, the sequence can be represented by (A - B) + (B - C) + (C - D) + (D - E) = A - E